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A CHECKLIST OF PLANTS OF DALHOUSIE SPRINGS AND THEIR IMMEDIATE ENVIRONS

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Abstract

Dalhousie Springs are the largest and most impressive of the artesian mound springs which are scattered along the western and southern margins of the Great Artesian Basin. A checklist of angiosperm plants is provided.

The nature and distribution of mound springs in South Australia have been described by Casperson (1979) and Harris (1981). Their presumed geological structure was described by Williams & Holmes (1978) and the analysis and flow of water from the Dalhousie Springs by Williams (1974), who states that all the waters are alkaline, the range in temperature is from 29 to 44°C, and they have salinities ranging from 650-2000 mg/l. The total flow from the whole area was estimated to be 0.86 cumecs. Dalhousie Springs are situated north-east of Oodnadatta at 26° 28′ Lat., 135° 29′ Long. in a valley in one of the most desolate areas of Australia. The mean annual rainfall is approximately 130 mm and evaporation approximately 3 m/yr. In the area are more than 70 discrete springs and the total area of vegetation maintained by the springs is 8.8 km², Williams & Holmes (1978).

The valley margin is bordered by break-away slopes leading up to desolate stony 'gibber' plains and the easternmost margin of the Springs is only 50 km from the western edges of the Simpson Desert. The approach to the valley of the Springs was graphically described by White (1914), "this patch [of land] is the most weird, the most woebegone, the most desolate, one can imagine. We had left the sandhill country earlier in the day and had then to cross rough upland gibber plains, broken here and there by bare flat-topped desert sandstone hills, then we descended into a depression and found the surface dotted over with strange dark coloured mounds out of which oozed from warm to hot water". Some of the plants collected by S.A. White on that expedition are still preserved in the State Herbarium.

The numerous springs in the group range from those with large clear pools and active water flow (up to 14.3 megalitres per day, Williams [1974]), while others trickle, seep or are moribund. The mounds vary in size from a few to 100 m in diameter generally with a shallow rounded profile and may be up to 10-12 m high. The valley floor has markedly saline areas due to the evaporation of the water and the lack of any flushing action by the very low annual average rainfall. The micro-habitats both close to the active springs and in the valley floor are numerous and range from warm-water aquatic sites with constant flow, through variously drained and exposed slopes to soils too salty to sustain vegetation.

The actual discovery of the Springs is described by Mr R.R. Knuckey, a contractor for a portion of the overland telegraph line and is published in Richards (1914). Since this publication is not readily available it is presented here. "At about 10 miles [from their camp] we found the soda flat and a small mound spring. About one mile north we came across another mound spring with reeds growing round it. I named the spring "Bee Spring" after Mr. Tom Bee, McMinns cadet. About 1½ miles from here we came on the main body of the springs. As far as the eye could reach to the east, the reeds showed the presence of the springs. To the north they were bounded by a low range of saddle-backed hills and to the westward the same range extended terminating in a point named Mount Crispe. The reeds where we struck the springs—(I measured one) were 17 feet high and as thick as your finger.

We could hear the gurgling among the reeds and as we had to camp there that night the horses had to be watered, so we cut down some reeds, made a corduroy road of them and led our horses to drink into as pretty a stream of water as a bushman could wish to see, about 3 feet wide, 18 inches deep, clear as crystal and fresh and sweet as mountain dew. We found the head of that spring. It was what we called a mud spring, that is the water (natural artesian wells) contained no sodium or magnesium, and therefore the overflow left no sediment.

Now before we left Adelaide, Lady Edith Ferguson, wife of Sir James Ferguson, the Governor of South Australia, had presented each of our parties with a box of books. These boxes contained all the standard novels of the day. Each box was different and there were 6 Bibles and 6 prayer books among them. Now we decided amongst ourselves that we would name the most important find after her and these springs came up to our expectations. They are the greatest area of springs in Australia. There is any kind of water you like in them, salt, magnesia, hot/cold and fresh and so that afternoon December 21, 1870, I christened them the Lady Edith Springs. As I was on the nearest section to Adelaide I sent in to our chief, Mr. Todd, the maps of the country as far as we had gone. Mr. Todd showed the map to Lady Edith, who wrote thanking us and asking us to change the name to her family name, Lady Edith was the daughter of the Marquis of Dalhousie, and that is how the Dalhousie was named."

The following people are known to have made some collections of plants at the Springs. S.A. White 1913, E.H. Ising 1932, W.S. Reid 1956, T.R.N. Lothian 1963, F. Mitchell 1968, T.J. Fatchen 1972, and P.K. Latz 1974, but as the specimens are now scattered through the herbarium collections they have not been included here. Those made by S.A. White were reported on by J.M. Black in White (1914b). My own collections were made in 1965, 1974, and 1983 and form the basis of the following account. They include species found in the immediate vicinity of the Springs and the associated saline flats, but not plants of the 'break away' slopes and gibber plains.

The plants closely associated with the springs and totally dependant on them for water are listed in Appendix I. Three trees dominate the spring vegetation. *Melaleuca glomerata* dominates the wet springs where it forms a large tree often with several trunks which may be 30 cm in diameter. The trunks are covered with copious pale paper-bark. The sprawling trunks and fallen trees show evidence of wind throw. *Myoporum acuminatum* is a small tree or large, bright green shrub which often surrounds the *Melaleuca* or is mixed with them. It is often abundant and occasionaly extends out on the 'tails' from the springs. *Acacia salicina* is a small, short lived tree often clonal in habit, and usually occupies the outer fringes and drier slopes of the low mounds. In some of the dry mounds, *A. salicina* may be the dominant tree. On the outer zones of the tree vegetation and on the upper slopes of the mounds may be found *Pimelea microcephala*, *Halosarcia* spp (samphires), *Enchylaena tomentosa* (ruby saltbush), and *Atriplex nummularia* (old man saltbush) and abundant *Sporobolus virginicus*.

Closely associated with free water are *Typha domingensis* (bulrush) and *Phragmites australis* (bamboo reed). On the mounds these combine with the *Melaleuca* and *Cyperus gymnocaulos* to form almost impenetrable thickets now much damaged by cattle, feral horses and donkeys forcing their way through, pugging the peaty ground and grazing the reeds. The bulrush and bamboo reed may extend from the centre of the mounds out to the distant tails, but do not occur on the drier phases. Occurring with these, but usually where more exposed and then extending to the drier phases of the tails, are extensive areas of *Cyperus gymnocaulos*. This tough species is less heavily grazed and the clumps may protect occasional plants of *Juncus kraussii*. The *Cyperus* also gives some protection to palatable plants such as *Sonchus* spp. (thistles) and *Senecio* affin. *cunninghamii* which are otherwise heavily grazed.

Fig. 1. *Typha* and *Phragmites* surrounding one of the largest free-water springs.

Fig. 2. General view of low mound showing the dense vegetation surrounding the large spring (out of sight). The farm implements were abandoned after efforts to use the spring for irrigation. Assorted halophytes in the foreground.

Within the mounds, close to water and sheltered by the preceding species the following may occur:-

Sonchus oleraceus
S. hydrophilus
Senecio affin. *cunninghamii*
Samolus repens
Hydrocotyle verticillata
Polygonum salicifolium

In open wet sites (but rarely in dense cover) occur:-

Cyperus laevigatus
Bolboschoenus caldwellii
Eleocharis pallens
Baumea arthrophylla
Hydrocotyle verticillata
Lemna disperma

The last five seem relatively rare and only few collections have been made.

Draining away from springs may be a long tail of vegetation as the water flows away, seeps through the ground and finally evaporates. The soils associated with these tails of vegetation become increasingly saline towards their ends and margins. Along the tails, but only associated with the free water phases, may be occasional *Melaleuca*, *Myoporum* together with *Typha* and *Phragmites*. In wet open areas may occur *Cyperus laevigatus*, (very common), *Bolboschoenus caldwellii* (very palatable). The drier phases with no free water are covered mainly by *Cyperus gymnocaulos* with occasional *Frankenia pauciflora*.

Very few aliens have become established. *Phoenix dactylifera* (dates) must be considered adventive if not naturalised as young plants now occur well away from the original planted palms at the Dalhousie ruins. In addition *Cyperus laevigatus* and *Polypogon monspeliensis* are considered introductions to the South Australian flora.

Fig. 3. *Frankenia muscosa* a compact hummock forming species on highly saline ground.

In the general vicinity of the springs the flats and dry lower slopes are dominated by *Halosarcia pluriflora*, *Sclerostegia tenuis* (samphires), *Nitraria billardieri* (nitre bush) and *Selenothamnus squamatus* with occasional plants of *Eremophila longifolia*, *E. duttonii*, *Acacia victoriae*, *Pittosporum phyllireaoides*,*Atriplex nummularia*, *Scaevola spinescens*, *Frankenia muscosa* and the small sub-shrubby chenopods *Enchylaena*, *Maireana* and *Sclerolaena*. Due to heavy rabbit grazing the smaller herbaceous plants are now rare, but the following have been collected: *Babbagia*, *Eragrostis*, *Enneapogon*, *Lawrencia*, *Pluchea*, *Sclerolaena*, *Pterocaulon* and *Zygophyllum*. The exclosures maintained by B.G. Lay of the South Australian Department of Agriculture have shown that the rabbits have a major effect on the persistence and regeneration of the herbaceous plants of the area (personal communication) in addition to the grazing and physical damage by the larger animals.

Plants associated with the saline flats are listed in Appendix II. The saline flats have resulted from the evaporation of the spring water and their plants have wider distributions, being found extensively in arid South Australia in similar ecological sites.

Approximately 60 km east of the Dalhousie Springs complex is Purnie Bore. This bore was put down during a period of oil exploration and has been flowing since 1964. The water forms a large lagoon several hundred metres long between the sand dunes. Regrettably since then this portion of the desert has been stocked with cattle.

Fig. 4. Regeneration of *Sporobolus virginicus* after 21 months protection from rabbits and stock. Photo per B. Lay.

In 1974, ten years after it was established, the following semi-aquatic plants were collected:

	Chara	Symon 9400
	Cyperus gymnocaulos Steudel	Symon 9395
*	*Cyperus laevigatus* L.	Symon 9397
*	*Heliotropium curassavicum* L.	Symon 9398
*	*Parapholis incurva* (L.) C.E. Hubb.	Symon 9399
	Schoenoplectus litoralis (Schrader) Palla	Symon 9396
	Typha domingensis (Pers.) Steudel	Symon 9394

On my most recent visit to this bore (June 1983), only the two species of *Cyperus* and *Typha* were evident. The area is heavily stocked and plants along the edge of the water are under severe grazing pressure. It is noticeable that none of the woody plants associated with Dalhousie Springs have become established. Conversely neither *Parapholis* nor *Schoenoplectus* have been detected at Dalhousie Springs yet. The two species of *Cyperus* and *Typha* now occur about almost all bores and springs in Central Australia where free water is available, and obviously have efficient methods of seed dispersal.

Conservation

The interesting geological origins of the springs and their unique place in the arid landscape justify their protection.

The fish fauna alone (not dealt with here) supports the claim as no fewer than six species occur there, one of which is confined to these springs, Glover & Sims (1978).

The importance of the free water for birds and local animals is obvious by their numbers. At least one thousand tree martins were seen hawking over one of the larger pools.

More thorough botanical sampling of the many sites will undoubtedly reveal species not yet collected. In the times and conditions available to me it has not been possible to visit all of the Springs. Nor was Williams (1974) information on water flow available when the first visits were made which could have assisted in selecting sites. From the collections made to date the following are noteworthy:-

Baumera arthrophylla, only record for northern South Australia.
Hydrocotyle verticillata, only record for northern South Australia.
Isolepis hookerana, new record for Central Australia.
Polygonum salicifolia, only record for northern South Australia.
Lemna disperma, a new record for Central Australia.
Goodenia anfracta)
Haloscarcia fontinalis)
Maireana luehmannii) These are all uncommon plants in South Australia.
Sclerolaena clelandii)
Zygophyllum crassissimum)
Nicotiana burbidgeae, a new species solely confined to the south-western end of the Springs complex.

Because of the permanent water and associated plant growth, this area suffers severe grazing pressure from cattle and horses, as well as feral rabbits and donkeys. Fencing off at least some of these springs and eradication of animals within these areas may well reveal new plant species, at present suppressed beyond recognition. The uniqueness of this whole complex of springs and associated landforms, quite apart from their intrinsic botanical interest, makes it essential they be given some form of protection. Vegetation damage caused by indiscriminate use of off-road vehicles has also increased alarmingly during the period of study. It would be a tragedy if this complex suffers the same fate as many of the mound springs further north—now totally devastated by uncontrolled animal use (Harris 1981).

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Appendix I

Plants closely associated with the Springs

Acacia salicina Lindley. Abundant, *Symon 3242, 3246, 9342, 13126, 13148.*
Amyema preissii (Miq.) Tieghem (on *Acacia*), *Symon 3245, 13161.*
Baumea arthrophylla (Nees) Boeckeler. Rare, *Symon 9331.*
Bolboschoenus caldwellii (V. Cook) Sojak. Occasional, *Symon 13158, 13170.*
Chara sp. *Symon 13168.*
Cyperus gymnocaulos Steud. Abundant, *Symon 3258, 9336, 13131, 13154.*
**Cyperus laevigatus* L. Abundant, *Symon 3248, 9337, 13130, 13169.*
Eleocharis ? pallens (Benth.) Blake. Rare, *Symon 3253, 9330, 13166.*
Enchylaena tomentosa R. Br. Abundant, *Symon 9308, 9311, 13124, 13142.*
Fimbristylis ferruginea (L.) Vahl. Rare, *Symon 3244, 13167.*
Frankenia pauciflora DC. Occasional, *Symon 3252, 9301, 9339, 13165.*
Frankenia muscosa Abundant, see App. II.
Hemichroa diandra R. Br. *Symon 9341.*
Hydrocotyle ? verticillata Thunb. Rare, *Symon 13162.*
Imperata cylindrica (L.) Beauv. Abundant, *Symon 3247, 9333, 13132, 13157.*
**Isolepis hookerana* Boeck. Uncommon, *Symon 13162A.*
Juncus kraussii Hochst. Occasional, *Symon 3256, 9335, 13156.*
Lemna disperma Hegelm. Rare, *Symon 13212.*
Melaleuca glomerata F. Muell. Abundant, *Symon 3259, 9307, 9359, 13134.*
Myoporum acuminatum R. Br. Abundant, *Symon 3241, 9310, 13127, 13146.*
**Phoenix dactylifera* L. Occasional, *Symon 3243, 9329, 13173.*
Phragmites australis (Cav.) Trin. ex Steudel. Abundant, *Symon 3255, 9334, 13133, 13172.*
Pimelea microcephala R. Br. Common, *Symon 9309, 13125.*
Polygonum salicifolium Brouss. ex Willd., Rare, *Symon 13129.*
**Polypogon monspeliensis* (L.) Desf., *Symon 9338.*
Samolus repens (Forst. et Forst. f.) Pers. Rare, *Symon 9327.*
Senecio affin. *cunninghamii* DC., Rare, *Symon 13160.*
Sonchus oleraceus L. Common, *Symon 13220.*
Sonchus hydrophilus Boulos, Occasional, *Symon 9328, 13159.*
Sporobolus virginicus (L.) Kunth., Abundant, *Symon 3249, 9344, 13137.*
Typha domingensis (Pers.) Steudel, Abundant, *Symon 3257, 13171.*

*The asterisk indicates introduced plants.

Appendix II

Plants on dry slopes of mounds or associated saline flats

Acacia victoriae Benth. Occasional, *Symon 9325, 13153.*
Atriplex nummularia Lindley. Common, *Symon 9317, 13179.*
Babbagia dipterocarpa F. Muell. Common, *Symon 9319, 13145.*
Centaurium spicatum (L.) Fritsch. Occasional, *Symon 3267.*
**Citrullus colocynthis* (L.) Schrader. Occasional, *Symon 13164.*
Cressa cretica L. Occasional, *Symon 3266, 9363.*
Enneapogon cylindricus N. Burb., *Symon 13141.*
Eragrostis dielsii Pilger. Common, *Symon 13136.*
" *falcata* (Gaudich.) Benth. Common, *Symon 13135.*
Eremophila duttonii F. Muell. Rare, *Symon 9322.*
" *longifolia* (R. Br.) F. Muell. Rare, *Symon 13178.*
Eucalyptus microtheca F. Muell. Rare, *Symon 3273.*
Frankenia muscosa J.M. Black. Common, *Symon 3250, 9315, 13175.*
Goodenia anfracta J.M. Black. Occasional, *Symon 9349, 13188, 13206.*
Gunniopsis papillata Chinnock. Rare, *Symon 9345.*
Halosarcia fontinalis P.G. Wilson. *Symon 9302.*
" *halocnemoides* ssp. *longispicata* P.G. Wilson. *S.A. White 117.*
" *indica* var. *leiostachya* (Benth.) P.G. Wilson. *Symon 9303.*
" *pluriflora* P.G. Wilson. *Symon 3254, 9312.*
" *undulata* P.G. Wilson. *Latz 4795.*
Heliotropium curassavicum L. Occasional, *Symon 3269.*
Hemichroa diandra R. Br. Occasional, *Symon 3272, 9341.*
Lawrencia glomerata Hook. Common, *Symon 3268, 9318, 13138.*
Maireana appressa (F. Muell.) P.G. Wilson. Occasional, *Symon 9347.*
" *luehmannii* (F. Muell.) P.G. Wilson. *Symon 3271, 9346, 13204.*
" *pentatropis* (Tate) P.G. Wilson. Common, *Symon 9313, 13147, 13152.*
Minuria cunninghamii (DC) Benth. *Symon 9291.*
Nitraria billardieri DC. Abundant, *Symon 9292, 9314, 13155.*
Pittosporum phylliraeoides DC. Rare, *Symon 9350.*
Pluchea rubelliflora (F. Muell.) Robinson. *Symon 9340.*
Pterigeron cylindriceps J.M. Black. *Symon 9290.*
Pterocaulon sphacelatum (Labill.) Benth. *Symon 13139.*
Scaevola collaris F. Muell. Common, *Symon 3270, 9326, 13189.*
" *spinescens* R. Br. Occasional, *Symon 9324.*
Sclerolaena diacantha (Nees) F. Muell. *Symon 9316.*
" *clelandii* (Ising) A.J. Scott. *Symon 13144A.*
" *constricta* (Ising) A.J. Scott. *Symon 13143, 13205.*
" *lanicuspis* (F. Muell.) Benth. *Symon 13144B, 13203.*
Sclerostegia tenuis (Benth.) P.G. Wilson. *Symon 9304, 9320, 13151.*
Selenothamnus squamatus (Nees) Melville. Occasional, *Symon 3251, 9343.*
Trianthema triquetra Willd. Localised on rock heap, *Symon 13176.*
Zygophyllum compressum J.M. Black. Occasional, *Symon 9321, 9348.*
" *crassissimum* Ising. Rare, *Symon 3274, 13207.*
" *ammophilum* F. Muell. Common, *Symon 13163, 13177.*

*The asterisk indicates introduced plants.